

La Niña and the Upcoming 2010-2011 Winter Season

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A satellite image of Earth from space, showing the Americas and the surrounding oceans. The text "Update on La Niña" is overlaid in red. The image shows the western coast of North America, Central America, and South America, with the Pacific Ocean to the west and the Atlantic Ocean to the east. Cloud patterns are visible over the oceans.

Update on La Niña

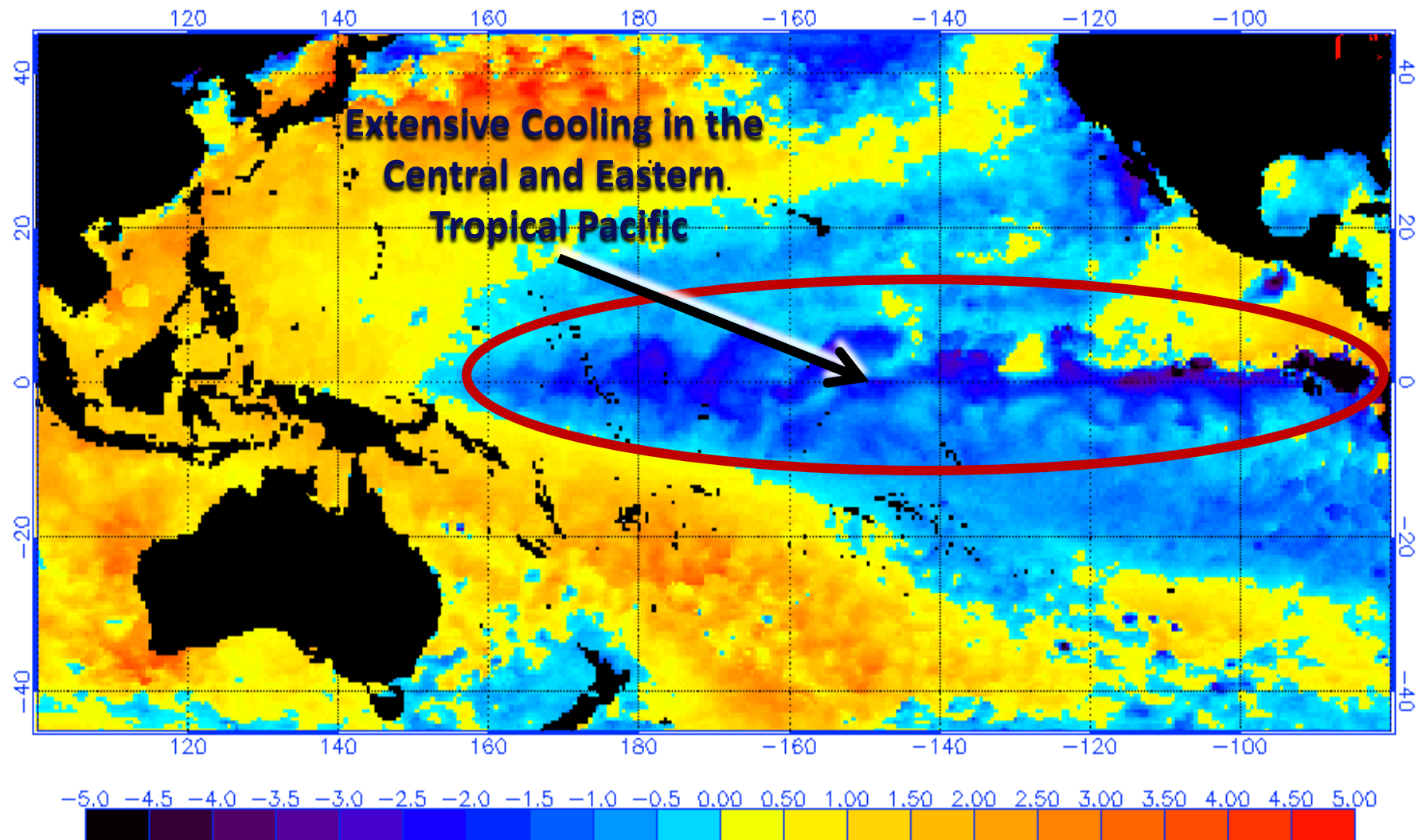
Overview

- **La Niña conditions persist in the central and eastern tropical Pacific Ocean.**
- **Sea surface temperatures (SSTs) in the tropical Pacific from near the International date line to the west coast of South America have ranged from -0.5C to -2.0C below average since late September.**
- **Recent Equatorial Pacific SST trends and model forecasts indicate that this La Niña will strengthen in the next couple of months and will continue at least through the Northern Hemisphere spring of 2011.**

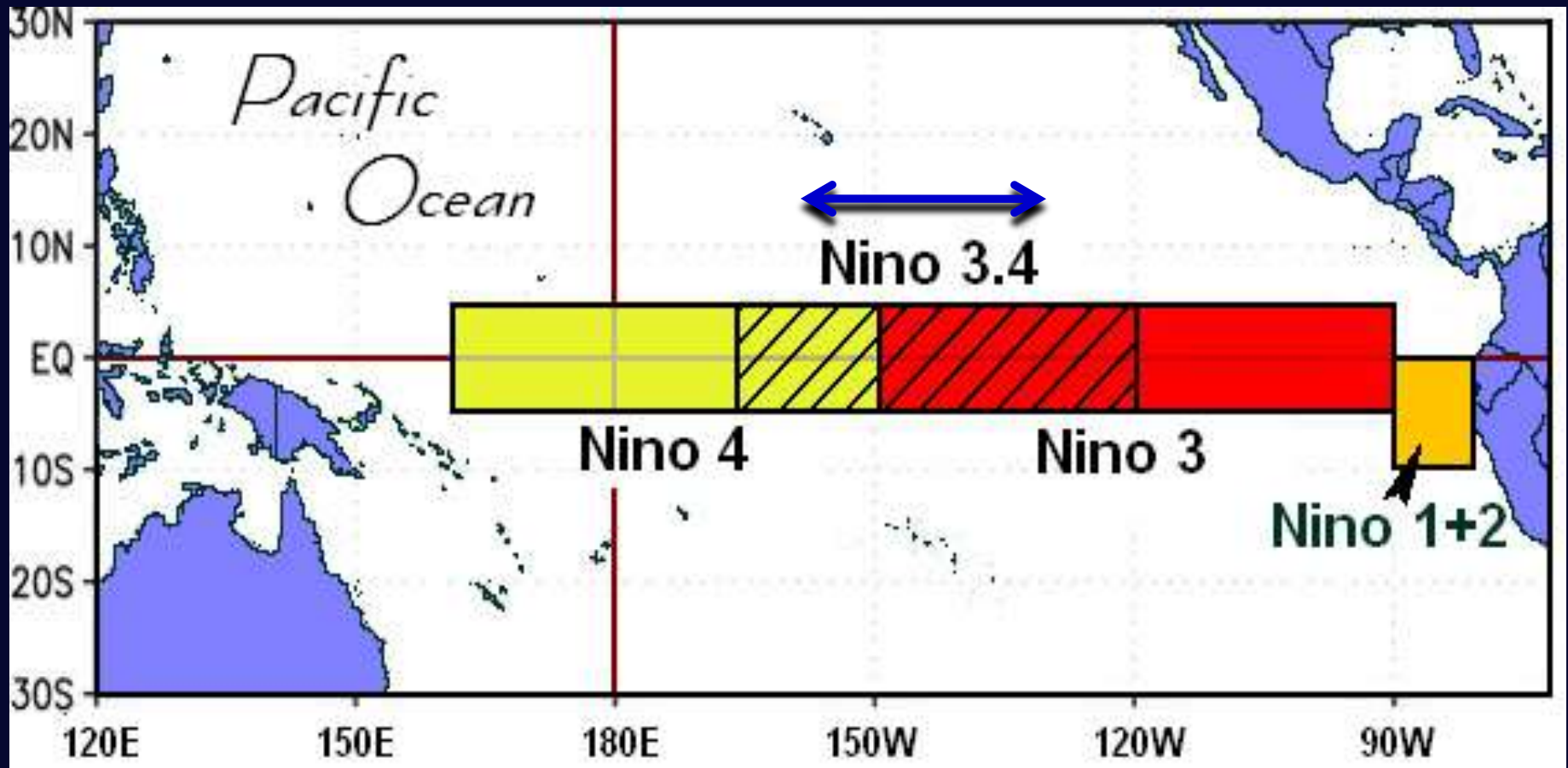
Overview

- **However, there remains some disagreement among the models over the eventual strength of this La Niña. A majority of the 23 climate models (dynamical and statistical models) predict a moderate-to-strong La Niña for the Northern Hemisphere winter.**
- **Given the strong cooling observed in the central and eastern Tropical Pacific over the last few months and the apparent ocean-atmosphere coupling (positive feedback), the outcome offered by the majority of the models is favored at this time.**

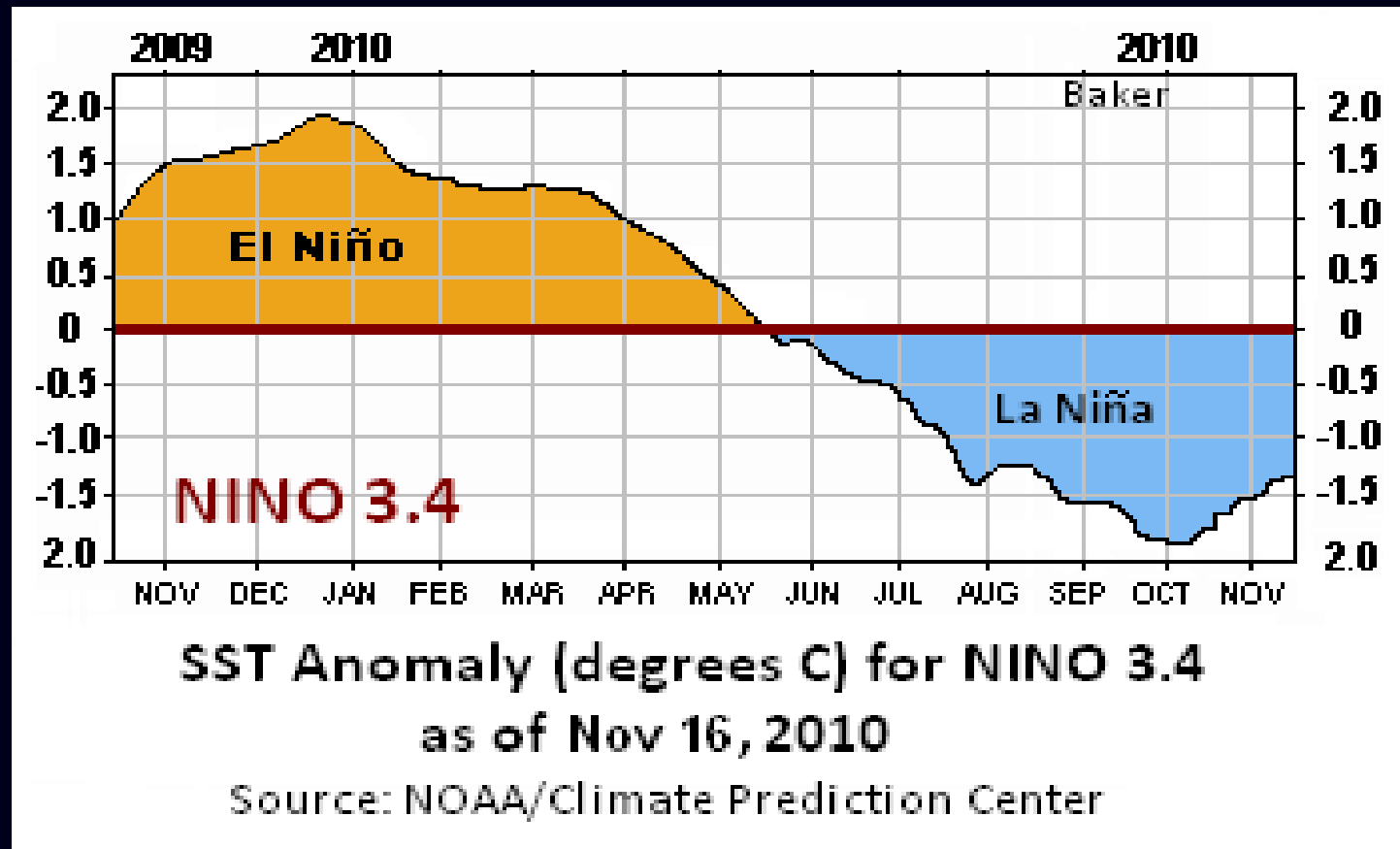
NOAA/NESDIS SST Anomaly (degrees C), as of 10/21/10



Niño Regions in the Tropical Pacific Ocean



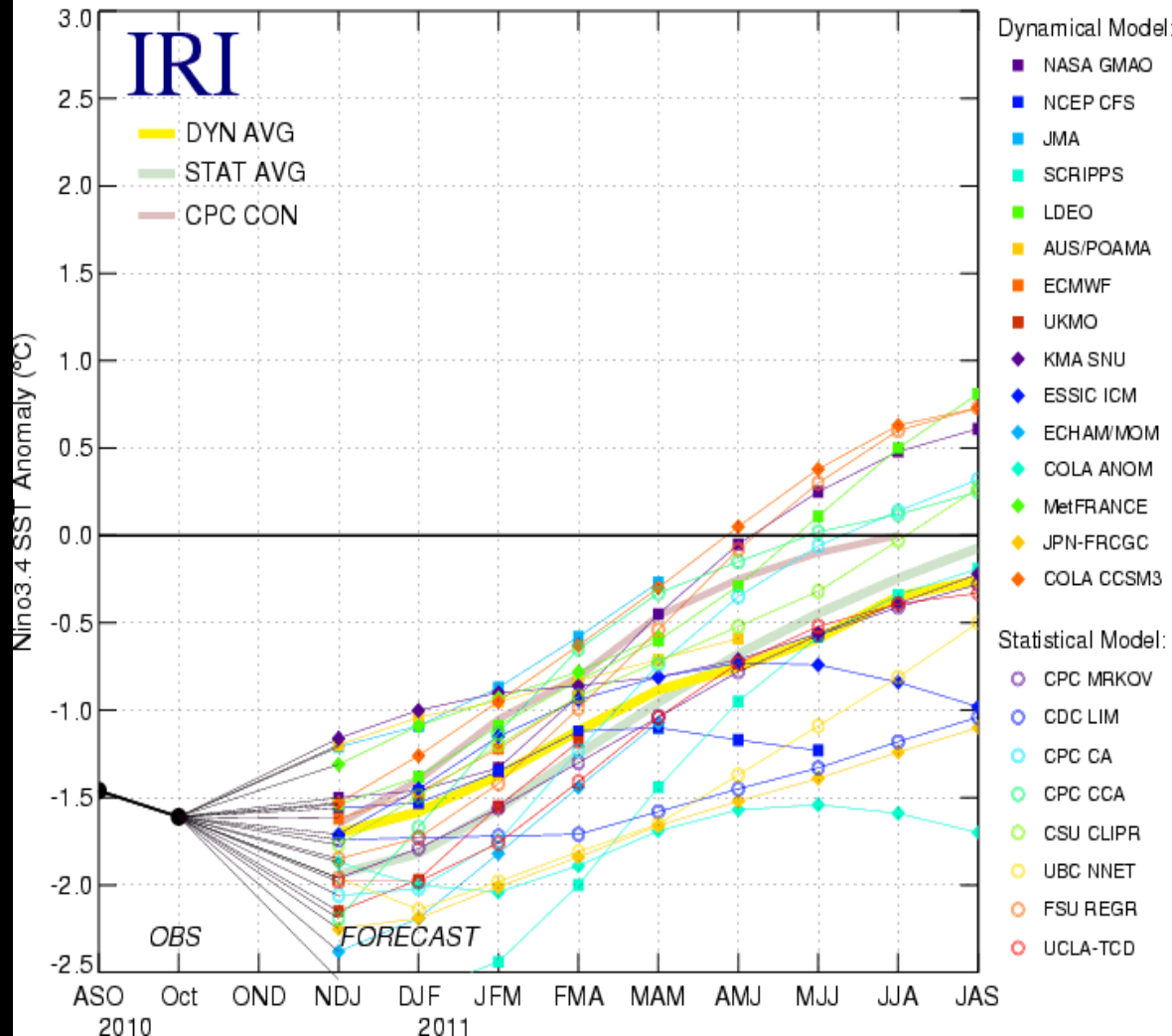
Niño 3.4 – The principal region in the eastern tropical Pacific used by the Climate Prediction Center (CPC) for monitoring, assessing and predicting ENSO.



Abnormally cool sea surface temperatures (SSTs) continued to be observed in the NINO 3.4 region of the Eastern Tropical Pacific. The mean SST value of -1.3°C as of November 16th is indicative of a strong La Niña. However, this value has warmed nearly 0.3°C in the past few weeks.

Pacific Niño 3.4 ENSO Outlook

Model Predictions of ENSO from Nov 2010



- A majority of the 23 dynamical and statistical ENSO models indicate either no change or a slight weakening in the current strong La Niña episode (-1.5°C or less) during the 3-month winter season of December-January-February 2010-2011. These same climate models also continue to indicate a La Niña of at least moderate strength (-1.0°C to -1.5°C) through the Northern Hemisphere spring of 2011.

NINO 3.4 Sea Surface Temperature Anomalies Forecasts

Forecast SST
Anomalies (deg C) in
the Nino 3.4 Region

Seasons (2010-2011)

Model	NDJ	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS
Dynamical models									
NASA GMAO model	-1.5	-1.5	-1.3	-0.9	-0.5	-0.1	0.3	0.5	0.6
NCEP Coupled Fcst Sys model	-1.6	-1.5	-1.4	-1.1	-1.1	-1.2	-1.2		
Japan Met. Agency model	-1.2	-1.1	-0.9	-0.6	-0.3				
Scripps Inst. HCM	-2.5	-2.6	-2.4	-2	-1.4	-1	-0.6	-0.3	-0.2
Lamont-Doherty model	-1.5	-1.4	-1.1	-0.8	-0.6	-0.3	0.1	0.5	0.8
POAMA (Austr) model	-1.2	-1	-1	-0.8	-0.7	-0.6			
ECMWF model	-1.6	-1.5	-1.2	-0.9					
UKMO model	-2.2	-2	-1.6	-1.2					
KMA (Korea) SNU model	-1.2	-1	-0.9	-0.9	-0.8	-0.7	-0.6	-0.4	-0.2
ESSIC Intermed. Coupled model	-1.7	-1.5	-1.2	-0.9	-0.8	-0.7	-0.7	-0.8	-1
ECHAM/MOM	-2.4	-2.2	-1.8	-1.4	-1.1				
COLA ANOM	-1.9	-2	-2	-1.9	-1.7	-1.6	-1.5	-1.6	-1.7
MÉTÉO FRANCE model	-1.3	-1.1	-0.9	-0.8	-0.6				
Japan Frontier Coupled model	-2.3	-2.2	-2	-1.8	-1.7	-1.5	-1.4	-1.2	-1.1
COLA CCSM3 model	-1.5	-1.3	-1	-0.6	-0.3	0.1	0.4	0.6	0.7
Average, dynamical models	-1.7	-1.6	-1.4	-1.1	-0.9	-0.8	-0.6	-0.3	-0.3

Seasons (2010-2011)

Model	NDJ	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS
Statistical models									
NCEP/CPC Markov model	-2	-1.8	-1.6	-1.3	-1	-0.8	-0.6	-0.4	-0.3
NOAA/CDC Linear Inverse	-1.7	-1.7	-1.7	-1.7	-1.6	-1.5	-1.3	-1.2	-1
NCEP/CPC Constructed Analog	-2.1	-2	-1.8	-1.2	-0.7	-0.4	-0.1	0.1	0.3
NCEP/CPC Can Cor Anal	-2.2	-1.7	-1.1	-0.7	-0.3	-0.2	0	0.1	0.3
Landsea/Kn aff CLIPER	-1.8	-1.5	-1.2	-0.9	-0.7	-0.5	-0.3	-0	0.3
Univ. BC Neural Network	-2	-2.1	-2	-1.8	-1.7	-1.4	-1.1	-0.8	-0.5
FSU Regression	-1.9	-1.7	-1.4	-1	-0.5	-0.1	0.3	0.6	0.7
TDC - UCLA	-2	-2	-1.8	-1.4	-1	-0.7	-0.5	-0.4	-0.3
Average, statistical models	-1.9	-1.8	-1.6	-1.3	-1	-0.7	-0.4	-0.2	-0.1
Average, all models	-1.8	-1.7	-1.4	-1.2	-0.9	-0.7	-0.5	-0.3	-0.2

Source: IRI

Oceanic Niño Index (ONI)

- The **ONI** is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.
- Defined as the three-month running-mean SST departures in the Niño 3.4 region.
- Used to place current events into a historical perspective
- **NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.**

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a **positive** ONI greater than or equal to +0.5 C.

La Niña: characterized by a **negative** ONI less than or equal to – 0.5 C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

Oceanic Niño Index - ONI

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1	-0.8	-0.6	-0.5	-0.4	-0.4	-0.4	-0.5	-0.6	-0.7
2001	-0.6	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.2	0.1	0	-0.1	-0.1
2002	-0.1	0.1	0.2	0.4	0.7	0.8	0.9	1	1.1	1.3	1.5	1.4
2003	1.2	0.9	0.5	0.1	-0.1	0.1	0.4	0.5	0.6	0.5	0.6	0.4
2004	0.4	0.3	0.2	0.2	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8
2005	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.1
2007	0.8	0.4	0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.7	-1	-1.1	-1.3
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0	0	0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6	-1.0	?			

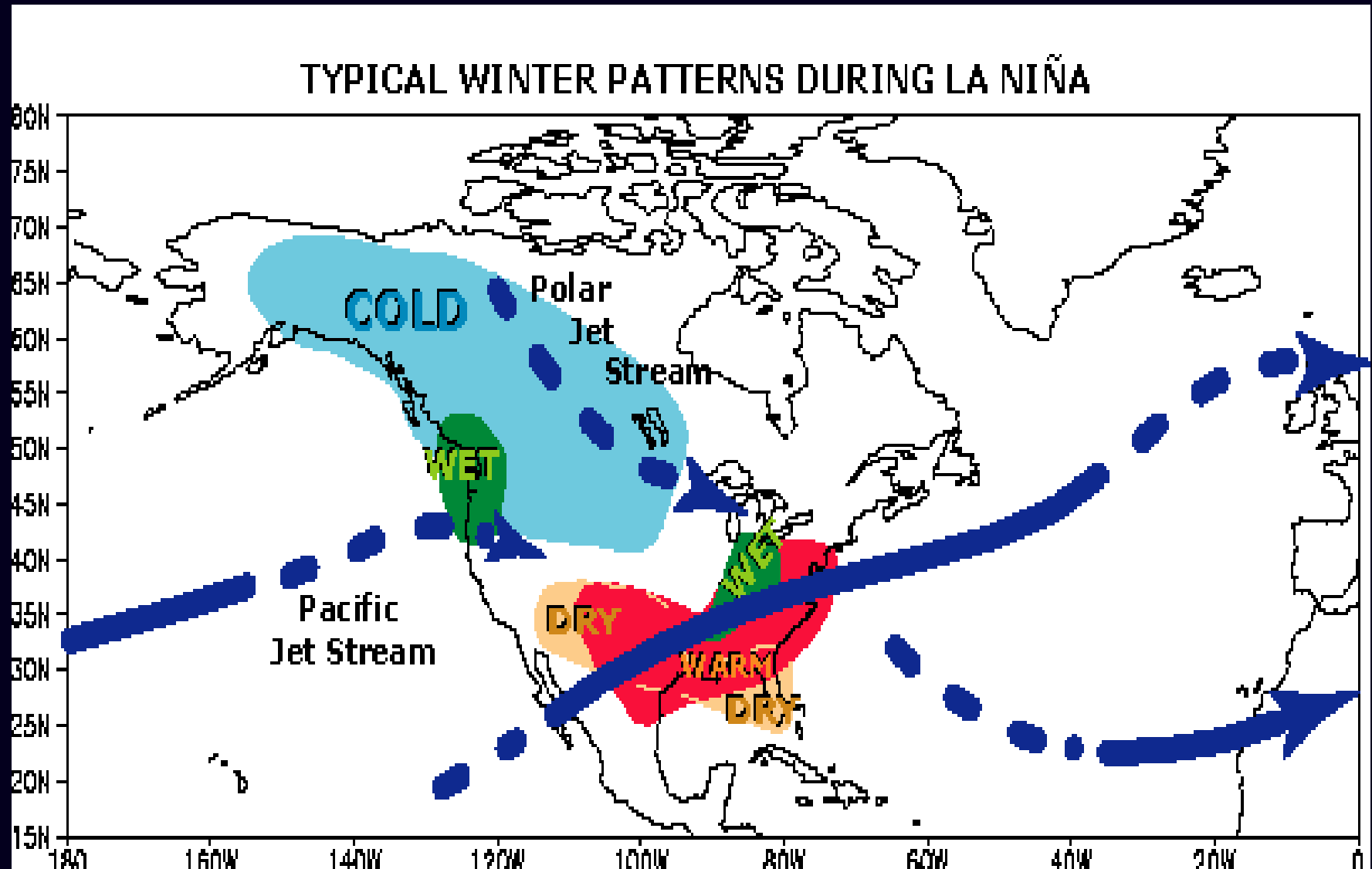
Not Yet
Available

Warm Episodes - El Niños (in RED): ONI 0.5 and above

Cold Episodes - La Niñas (In Blue): ONI of -0.5 and below

Neutral Episodes -non-ENSO (In White): ONI above -0.5 and below 0.5

Typical North American Temperature, Precipitation and Jet Stream Patterns during La Niña Winters



Source: NOAA/Climate Prediction Center

The Jet Stream and Its Influence on Colorado Weather



Three different jet stream positions typically observed over the western continental U.S. during the autumn, winter and spring.

A persistent **northwest jet stream pattern** typically produces above average precipitation and below average temperatures across west central and northwest Colorado, particularly during the winter and early springtime of moderate to strong La Niñas .

This same persistent jet stream pattern also typically produces below to much below average precipitation, and above average temperatures across southern and eastern Colorado, as well as periods gusty and potentially damaging downslope winds (both Chinook and Bora wind types) in the lee of the Colorado Front Range, particularly during the late autumn, and winter and spring of moderate strong La Niñas.

The Jet Stream and Its Influence on Colorado Weather



Three different jet stream positions typically observed over the western continental U.S. during the autumn, winter and spring.

A persistent **westerly or zonal jet stream pattern** typically produces above average precipitation, near average temperatures, and a greater than average number of days with cloud cover and valley fog across western Colorado.

This same stream pattern also typically produces below average precipitation, very low humidity, and above average temperatures in areas roughly east of the Continental Divide. There is a greater tendency for Front Range abnormally warm and dry Chinook downslope wind events, particularly during the autumn, late winter and early spring of moderate to strong La Niña episodes.

The Jet Stream and Its Influence on Colorado Weather



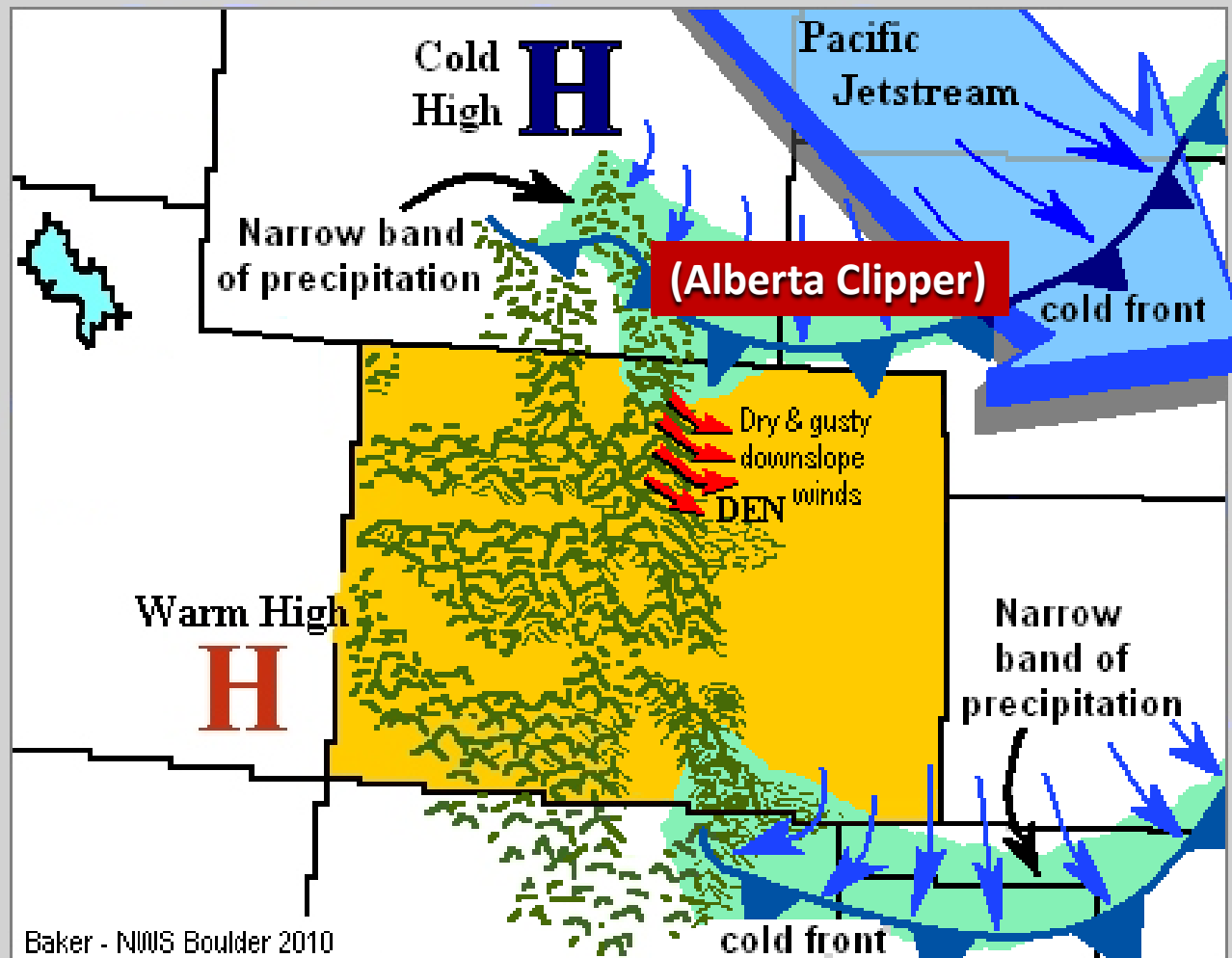
Three different jet stream positions typically observed over the western continental U.S. during the autumn, winter and spring.

Finally, a persistent **southwest jet stream pattern** typically produces above and even much above average precipitation and below average daytime temperatures across southwest and south central Colorado during winter and springtime of moderate to strong El Niño episodes.

This same persistent jet stream pattern also typically produces above average precipitation and near average temperatures in areas roughly east of the Continental Divide, and below average precipitation across northwest and north central Colorado particularly during the winter and springtime of moderate to strong El Niños.

Prominent Weather Patterns
Affecting Colorado
During
Moderate to Strong La Niñas.

Mean Position of the Pacific Jet Stream During the Autumn Season of Moderate to Strong La Niña Episodes

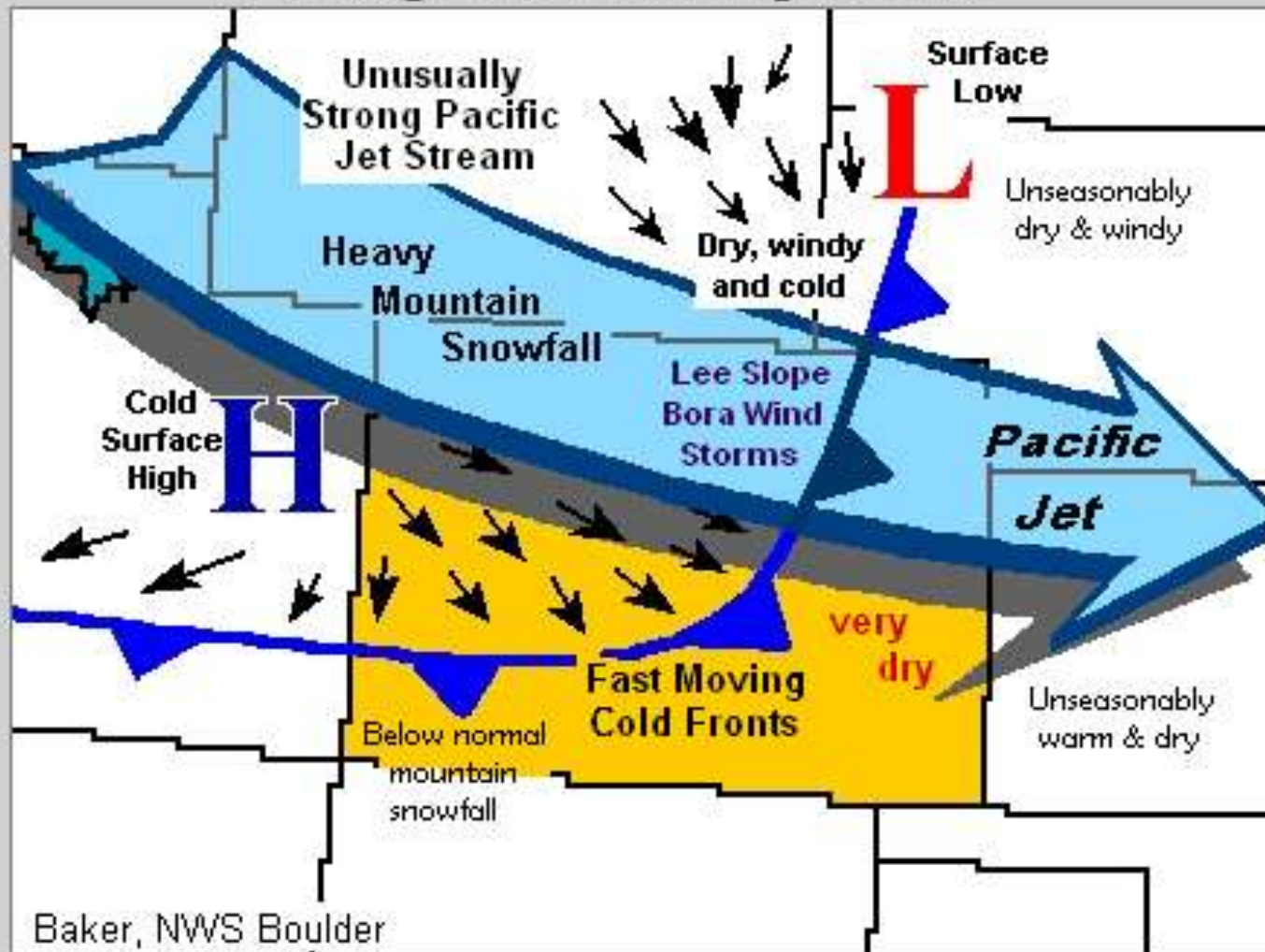


Eastern Colorado will commonly see an increase in the number of “dry” cold fronts, referred to as “Alberta clippers” during the autumn of moderate to strong La Niñas with the Pacific jet stream oriented in this position.

These fast moving cold front often produce little precipitation, and due of their fast movement, often produce strong and gusty northerly winds and sudden drops temperature.

Western Colorado will feel little, if any impact from these high plains frontal systems.

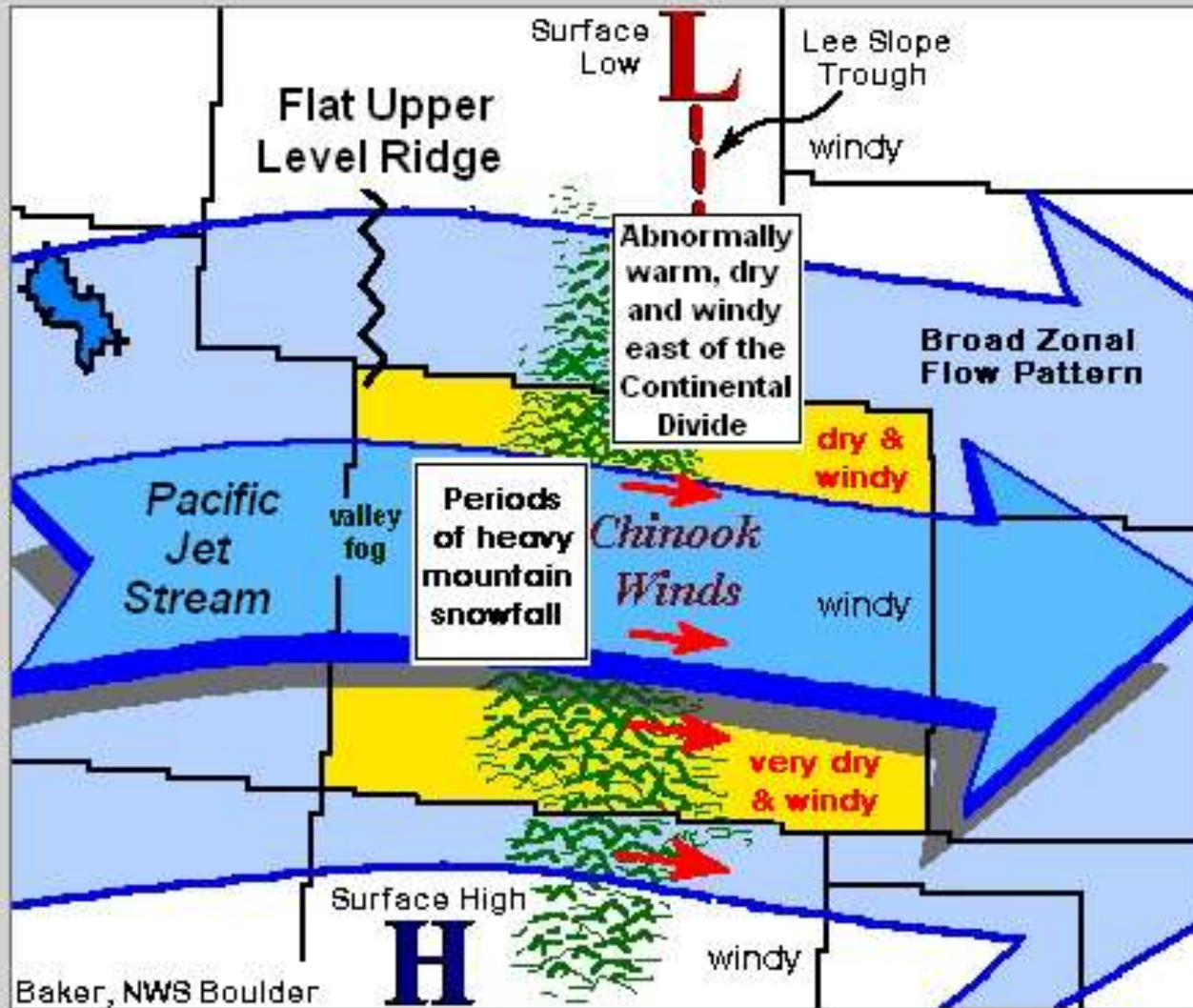
Mean Position of the Pacific Jet Stream Late Autumn and Winter of Moderate to Strong La Niña Episodes



As the west coast high pressure ridge weakens and flattens, the Polar jet stream acquires more of a west-northwesterly component.

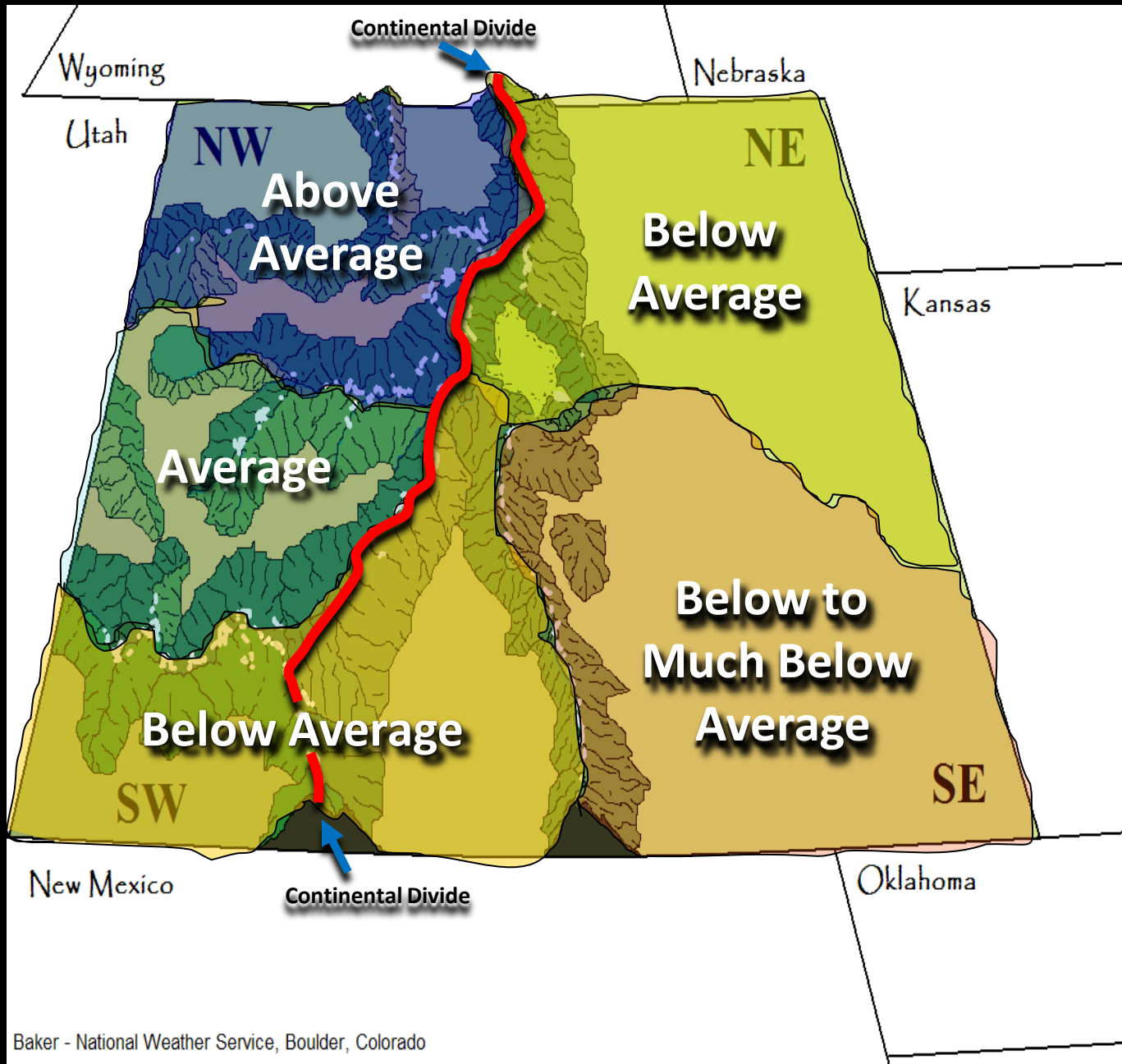
This southward shift in the jet results in an increase, often a significant increase, in precipitation and wind across the northwest plateau and north central mountains of Colorado.

Mean Position of the Pacific Jet Stream During the Spring of Moderate to Strong La Niña Episodes



In late winter and spring during the stronger La Niña episodes, the prevailing flow aloft usually becomes predominantly zonal or westerly in direction. This generally warmer and drier flow pattern still manages to produce periods of moderate to heavy snowfall on west facing mountain slopes along and west of the Continental Divide.

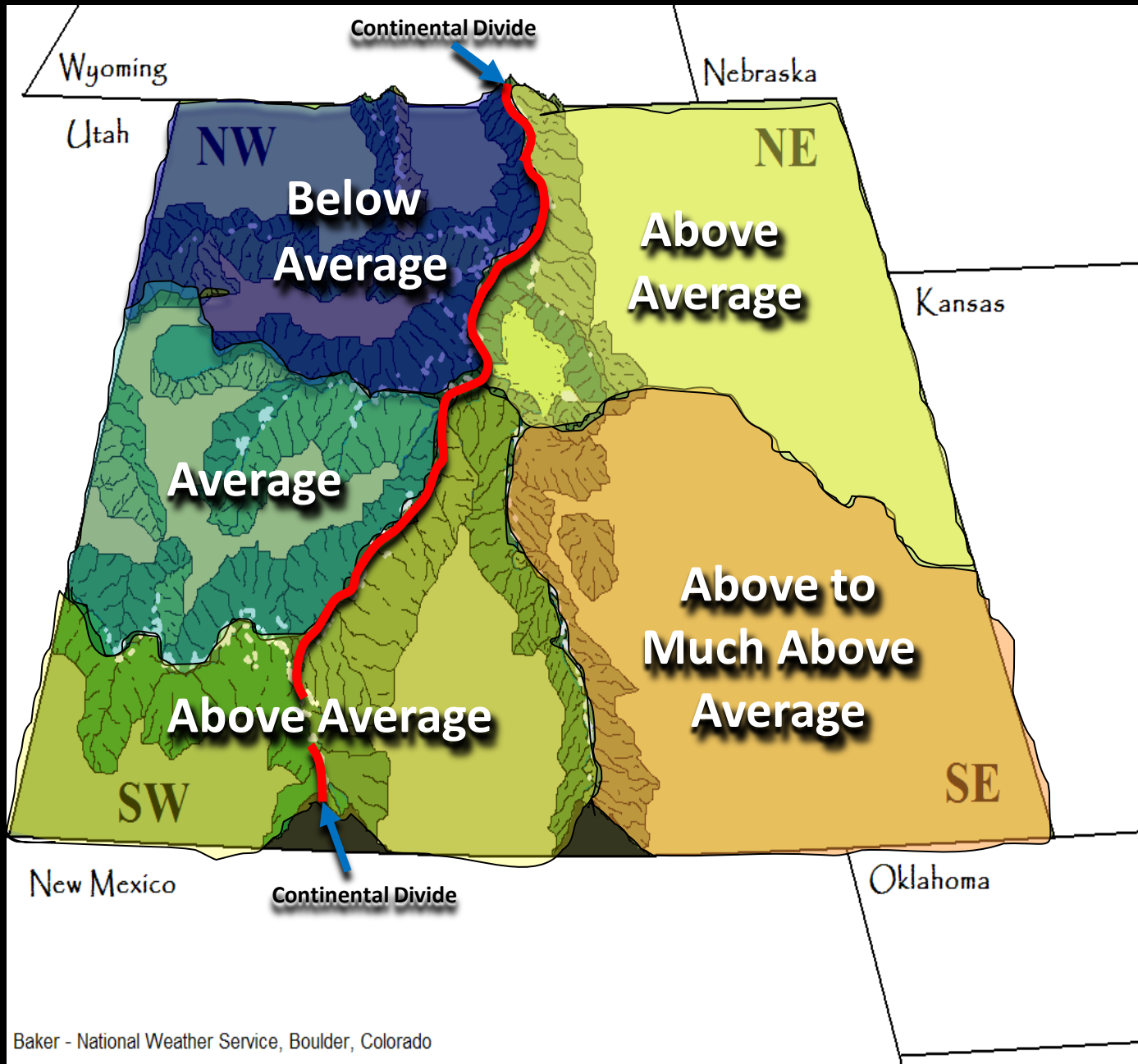
Whereas in areas east of the Divide, the weather is often abnormally warm, windy and quite dry for days, if not for weeks at a time.



Winter Season Precipitation Anomalies Commonly Observed During Moderate to Strong La Niña Episodes

West central and northwest Colorado commonly receives **AVERAGE** to **ABOVE AVERAGE** precipitation (rain and snow) during moderate to strong La Niñas, predominately from mid-winter through mid-spring.

While southwest and eastern Colorado commonly see **BELOW** to **MUCH BELOW AVERAGE** precipitation (rain and snow) during the entire cold season of moderate to strong La Niñas.



Winter Season Temperature Anomalies Typically Observed During Moderate to Strong La Niña Episodes

Temperatures across northwest Colorado typically run **BELOW AVERAGE**, particularly when there is an extensive snow cover.

Elsewhere, winter season temperatures run **AVERAGE** to **ABOVE AVERAGE**, except across the southeast quarter of Colorado where temperatures typically run **ABOVE** to **MUCH ABOVE AVERAGE**.

Potential Impacts of a Moderate to Strong La Niña on the Colorado Front Range



Above Average
Temperatures



Increased Risk of
Wildland Fires



Below Average
Precipitation
and Even
Drought



Significantly Reduced Runoff
Into Area Lakes and Reservoirs

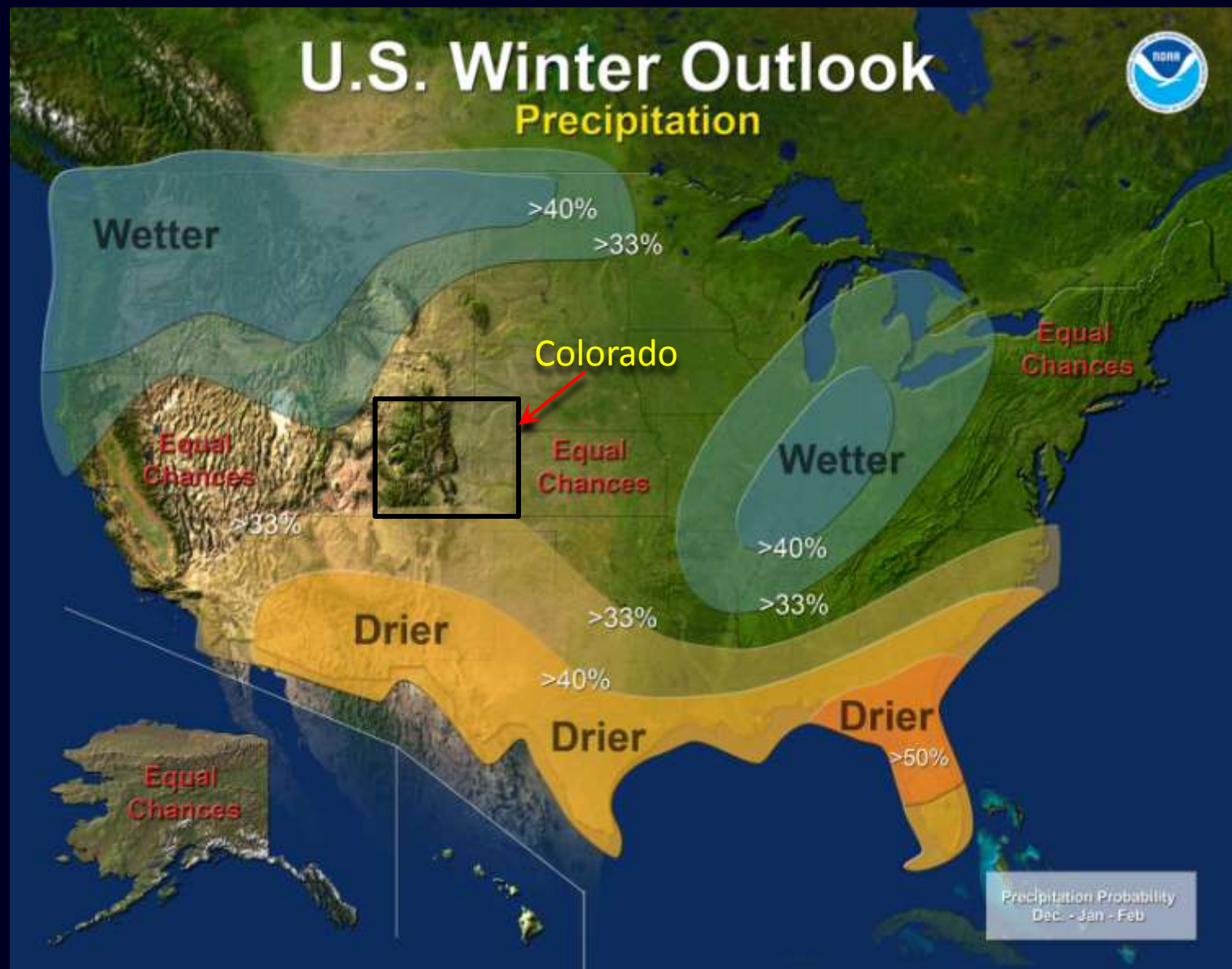


Damaging Downslope
Wind Storms

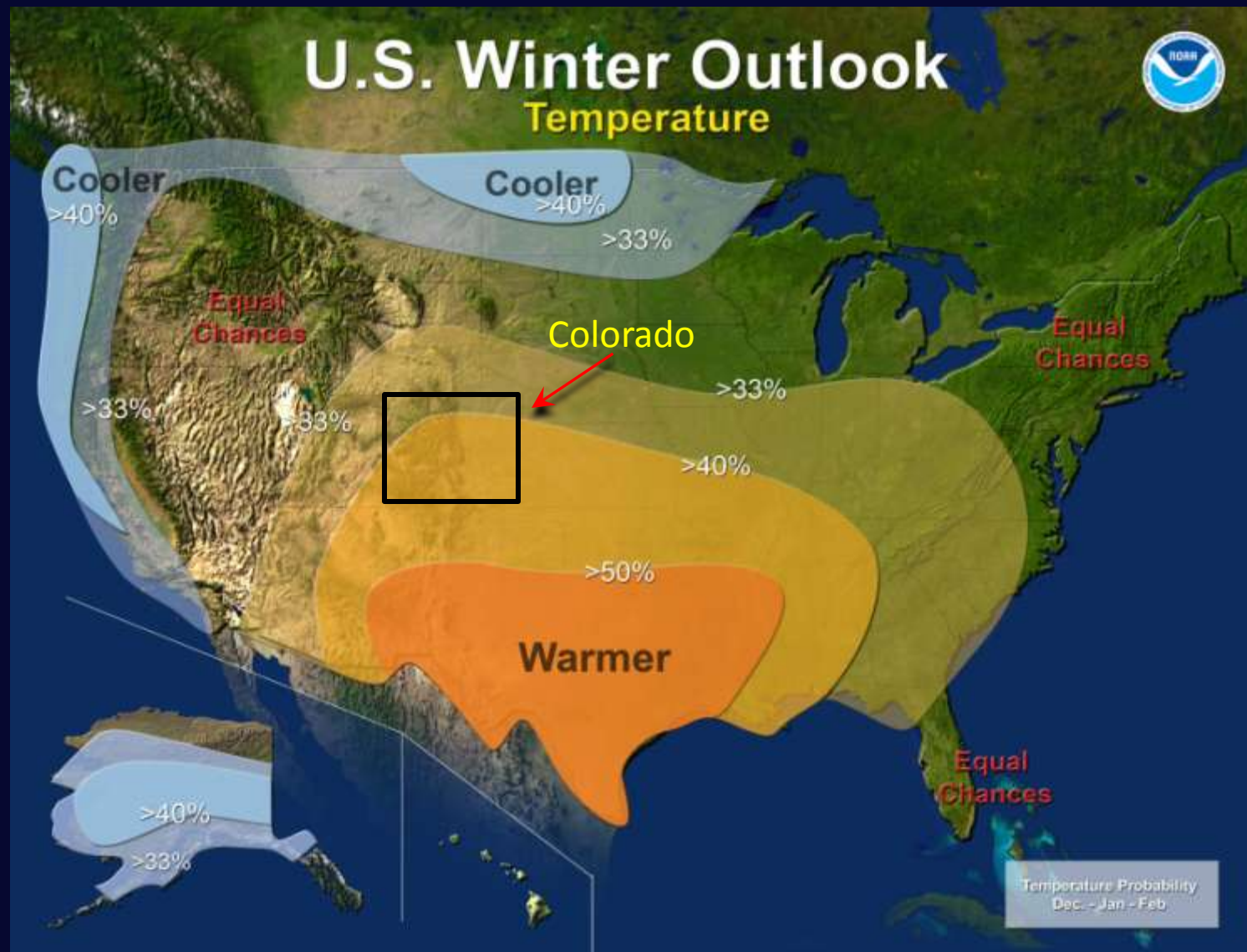
Official Outlook
for the 2010-2011
Winter Season
Issued by NOAA's
Climate Prediction Center



The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, the ENSO cycle.

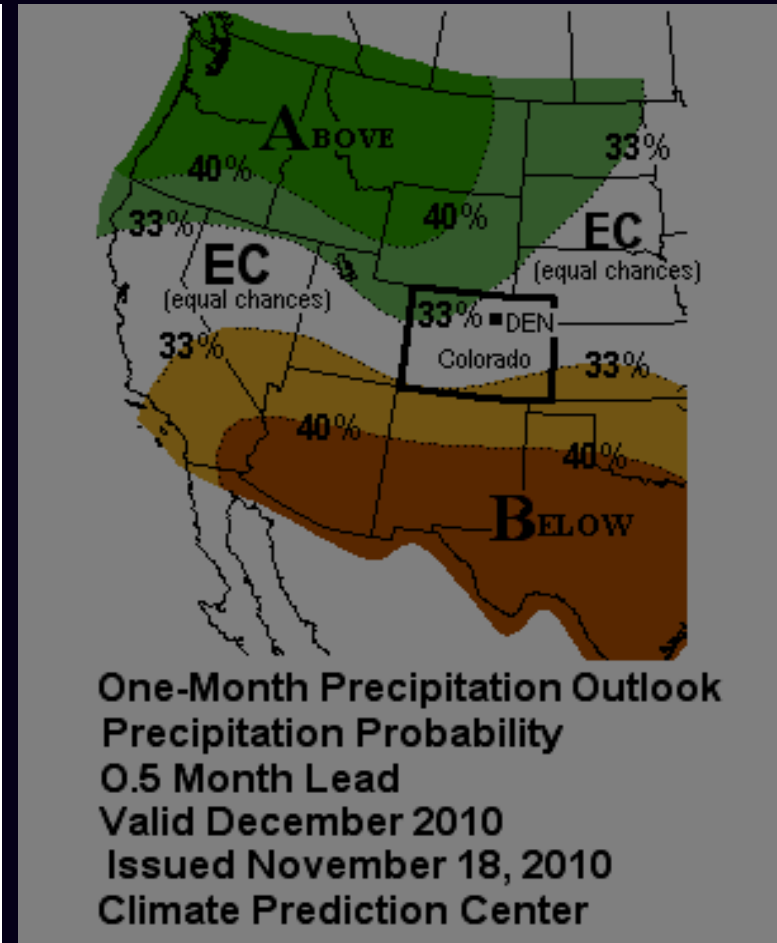
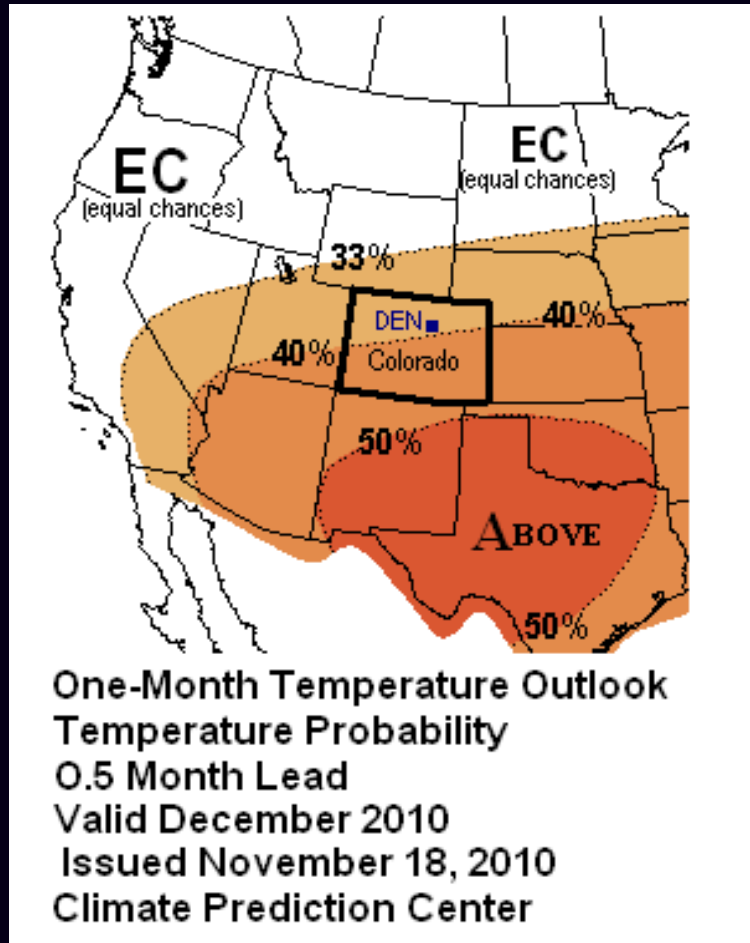


Precipitation Probability for the 3-month winter season of
December, January and February
Issued by NOAA's Climate Prediction Center



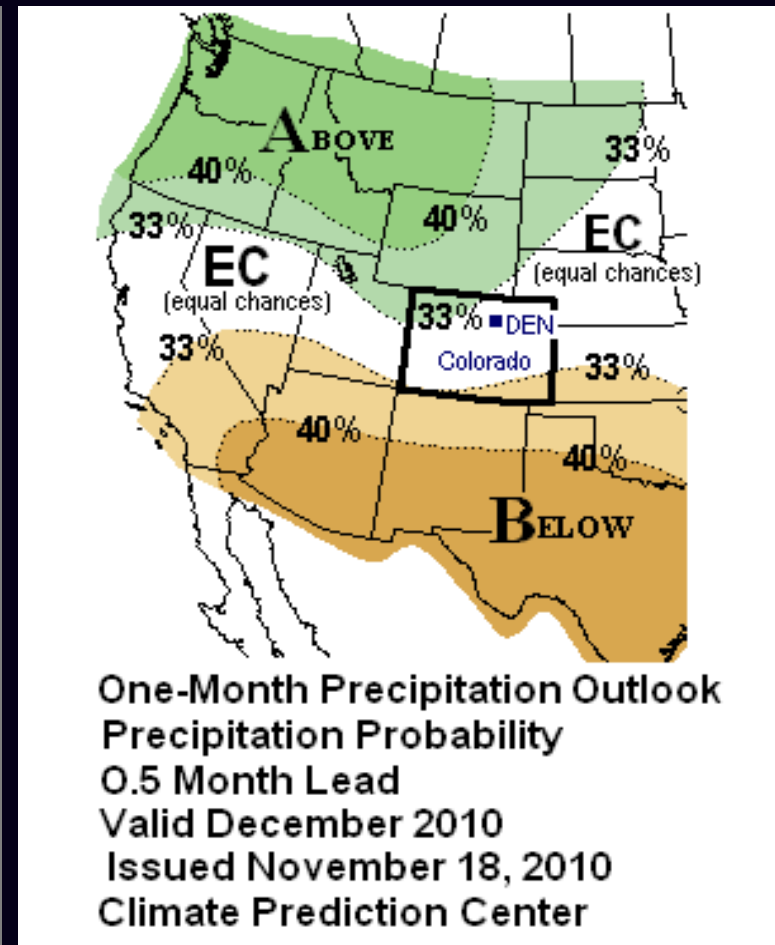
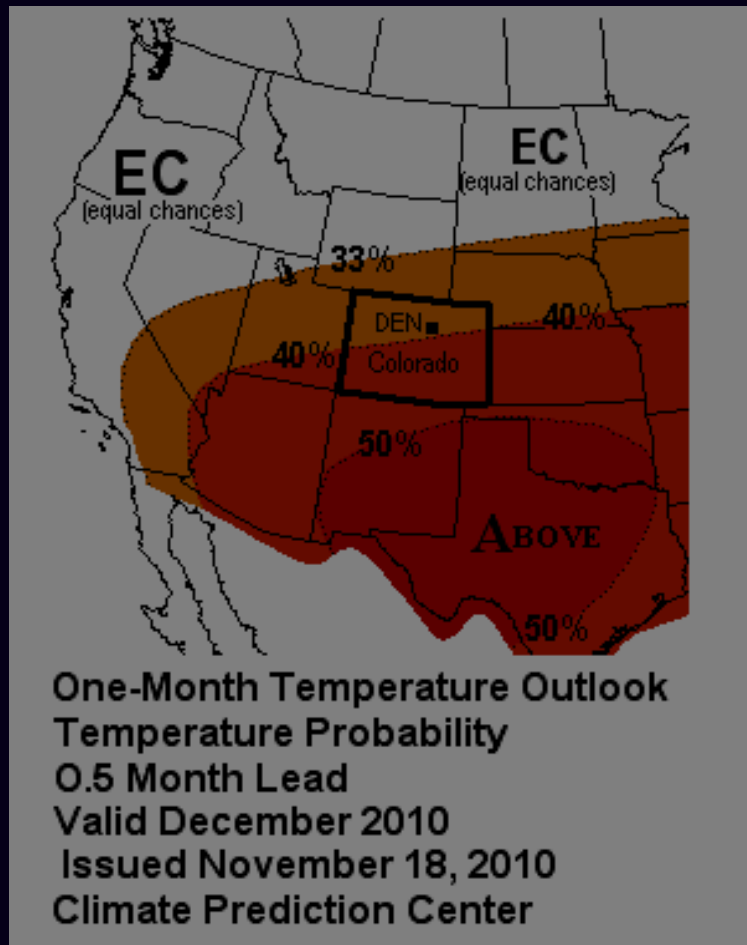
Temperature Probability for the 3-month climate season
of December, January and February
Issued by NOAA's Climate Prediction Center

December 2010 Temperature Outlook for Colorado



The December 2010 temperature outlook for Colorado as issued by NOAA's Climate Prediction Center is for a 33-40% probability of above average temperature across roughly the northwest half of Colorado, and a 40-50% chance of above average temperature across roughly the southeast half of the state.

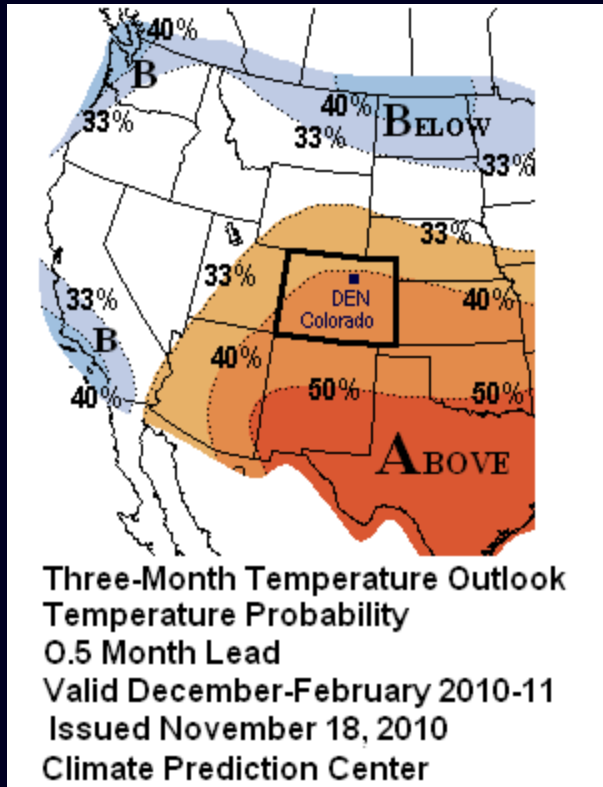
December 2010 Precipitation Outlook for Colorado



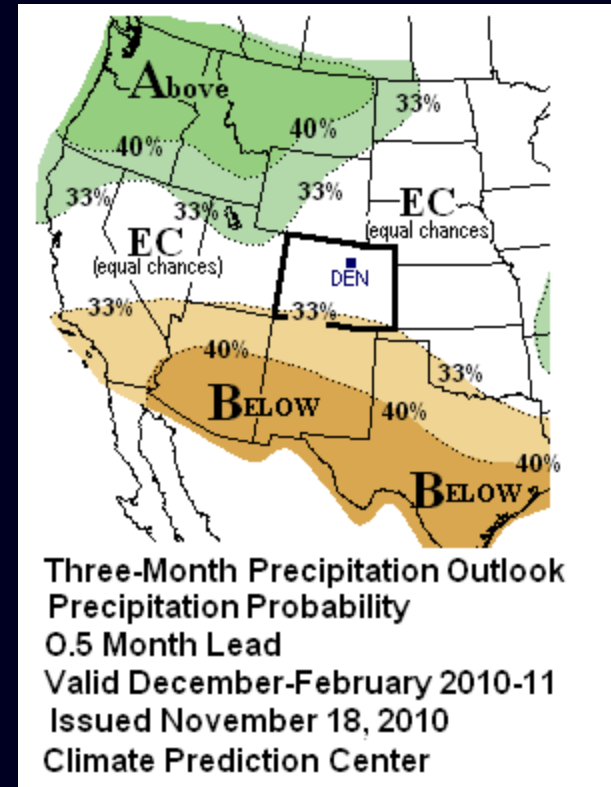
The December 2010 precipitation outlook for Colorado as issued by NOAA's Climate Prediction Center is for a 33-40% probability of above average precipitation across the northwest corner of the state, a 33-40% chance of below average precipitation across the southeast corner of Colorado, and an equal (or undeterminable) chance of above, below and near average precipitation across the remainder of the state.

Seasonal Temperature and Precipitation Outlooks December - February 2010-2011

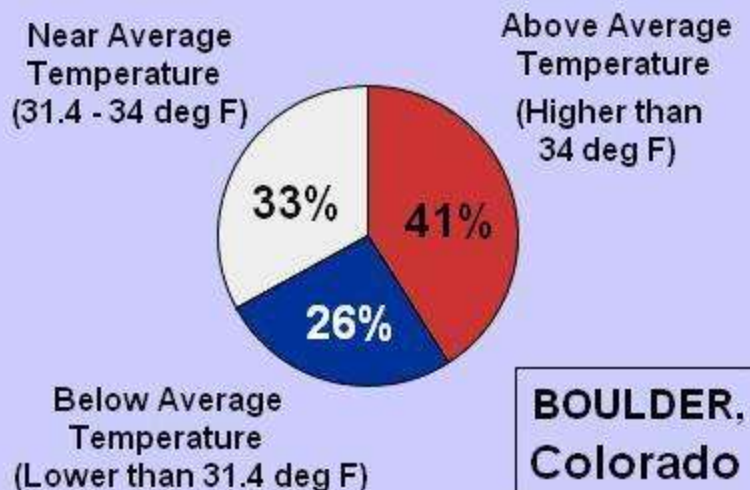
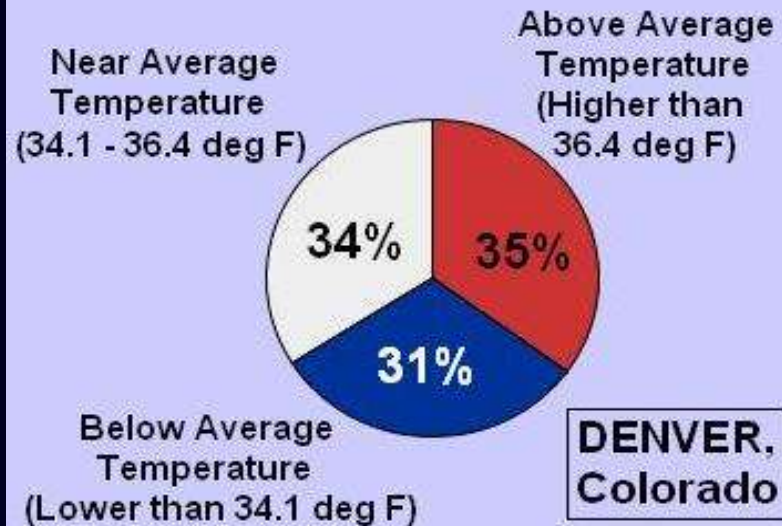
Temperature



Precipitation



The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, the ENSO cycle.



December-January-February
2010-2011
Temperature
Outlook for Denver and
Boulder, Colorado Issued
by NOAA's
Climate Prediction Center

Summary

La Niña conditions are present across the central and eastern tropical Pacific Ocean.

Equatorial SSTs are as much as 2 to 4 degrees C below average from the Date Line eastward to the South American coast.

Recent equatorial Pacific SST trends and model forecasts indicate La Niña will continue at least through the spring of 2011.

The current La Niña is forecast to produce above average temperatures and below average precipitation across most of Colorado...specifically southern and eastern portions of the state at least through the upcoming winter season.

Meanwhile the northwest and north central portions of Colorado are in line to see above average precipitation (snowfall) and below average temperatures, particularly during the latter half of this winter and perhaps through the spring of 2011.